Date: February 25, 2008 | Category: Stars - Individual, Binaries, Clusters | Proposal: 2214

National Research Council of Canada, Herzberg Institute of Astrophysics
DAO 1.8-m TELESCOPE OBSERVING TIME REQUEST
Quarter: 2008B

1. Title of the Program *(may be made publicly available for accepted proposals)*:

The Plaskett Spectroscopic Supernova Survey: Real Time Classification and Spectral Library Acquisition

2. Principal Investigator: **Eric Hsiao**

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3. Co-Investigators:

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Chris Pritchet	Institute: University of Victoria	E-mail: pritchet@uvic.ca

4. Summary of the Program *(may be made publicly available for accepted proposals)*:

The goals of the proposed program are to acquire spectroscopic confirmation and typing of newly discovered supernovae, and to compile a library of evolving supernova spectra.

5. Summary of the Observing Run Requested:

Instrument	Detector	Filters and/or Central Wavelengths
Spectrograph: 21(3/2)1	SITe5 - spec.	5500 Angstroms

# of nights	Robotic/Contract?	Moon (d)	Opt. LST at 0:00 HST	Min. LST at 0:00 HST	Max. LST at 0:00 HST
21	NO	10	Any	Any	Any

6a. Is this a Thesis Project? YES 6b. If yes, indicate supervisor: Dr. Chris Pritchet

7. Special instrument or telescope requirements:

2 arcsecond slit width

8. Scheduling constraints and non-usable dates:

The observing nights, preferably during dark time, should be as evenly spread out throughout the quarter as possible (e.g., seven three-night-runs) to ensure good temporal coverage.

9. Is this program conducted in relation with other observations (optical, radio, space)?

NO

10. Scientific Justification and References *(science background and objectives of the proposed observations: 1 page maximum)*:

Supernovae play an important role in shaping our universe. They are markers of dust properties and star formation history of external galaxies. They are the main mechanism for creating heavy elements and the main source of neutrinos beyond the Big Bang. They are also the most powerful tool currently available for studying the expansion history of the universe and the nature of dark energy.

These studies depend critically on the observations of nearby supernovae. The goals of the proposed observations are to spectroscopically confirm and type nearby supernovae and to make time series spectroscopic observations of these supernovae. The Plaskett Spectroscopic Supernova Survey began in the quarter of 2007C.

On a given night, there are 10 to 20 nearby supernovae at bright enough phases to be observed by the Plaskett telescope. Some of these supernovae will require spectroscopic typing. Type Ia supernovae are distinguished from core collapse supernovae by the presence of Si II lines and the absence of hydrogen and helium in their spectra. Type II supernovae are identified by their characteristic broad $H\alpha$ P Cygni profiles.

In 2007C, we spectroscopically classified SN 2007gk as a Type Ia supernova within two days of its discovery (Hsiao et al. 2007). In 2008A, with refined observing strategies, the survey spectroscopically classified three more supernovae, SN 2008L (Hsiao et al. 2008a), SN 2008P (Hsiao et al. 2008b) and SN 2008ak (Hsiao et al. 2008c).

The properties of a supernova evolve on a timescale of days as the supernova expands after the explosion. Time series spectroscopic observations therefore provide valuable diagnostics from different layers of the supernova as the photosphere recedes toward the core. The survey has so far obtained 17 spectra of 11 supernovae. A subsample of the spectra is presented in Figure 1.

The emergence of new subclasses of Type Ia supernovae reflects our lack of physical understanding and offers new insights to the nature of these objects. We have so far observed two such peculiar Type Ia supernovae.

Preliminary analysis of the spectrum of SN 2007gk observed in 2007 showed it to be similar to the spectrum of peculiar Type Ia SN 2002bo (Benetti et al. 2004) at pre-maximum phases. Both supernovae have Si II 6355Å lines which are more intense and at higher velocities than a normal Type Ia supernova at the same phase (e.g. SN 2008L in Figure 1).

Preliminary analysis of the spectrum of SN 2008A observed in 2008 showed it to be similar to the spectrum of peculiar Type Ia SN 2005hk (Phillips et al. 2007) at a few weeks past maximum light. Both supernovae have narrow features near the Si II 6355Å line and unusually slow expansion velocities compared to a normal Type Ia (e.g., SN 2007fb in Figure 1). The characteristic narrow features are possibly from partially burnt material, supporting the scenario of a pure deflagration explosion.

References

Benetti, S., et al. 2004, MNRAS, 348, 261
Hsiao, E. Y., et al. 2007, CBET, 1025, 1
Hsiao, E. Y., et al. 2008a, CBET, 1219, 1
Hsiao, E. Y., et al. 2008b, CBET, 1224, 1
Hsiao, E. Y., et al. 2008c, CBET, 1267, 1
Phillips, M. M., et al. 2007, PASP, 119, 360

11. Figures *(all figures must appear on a single page)*:

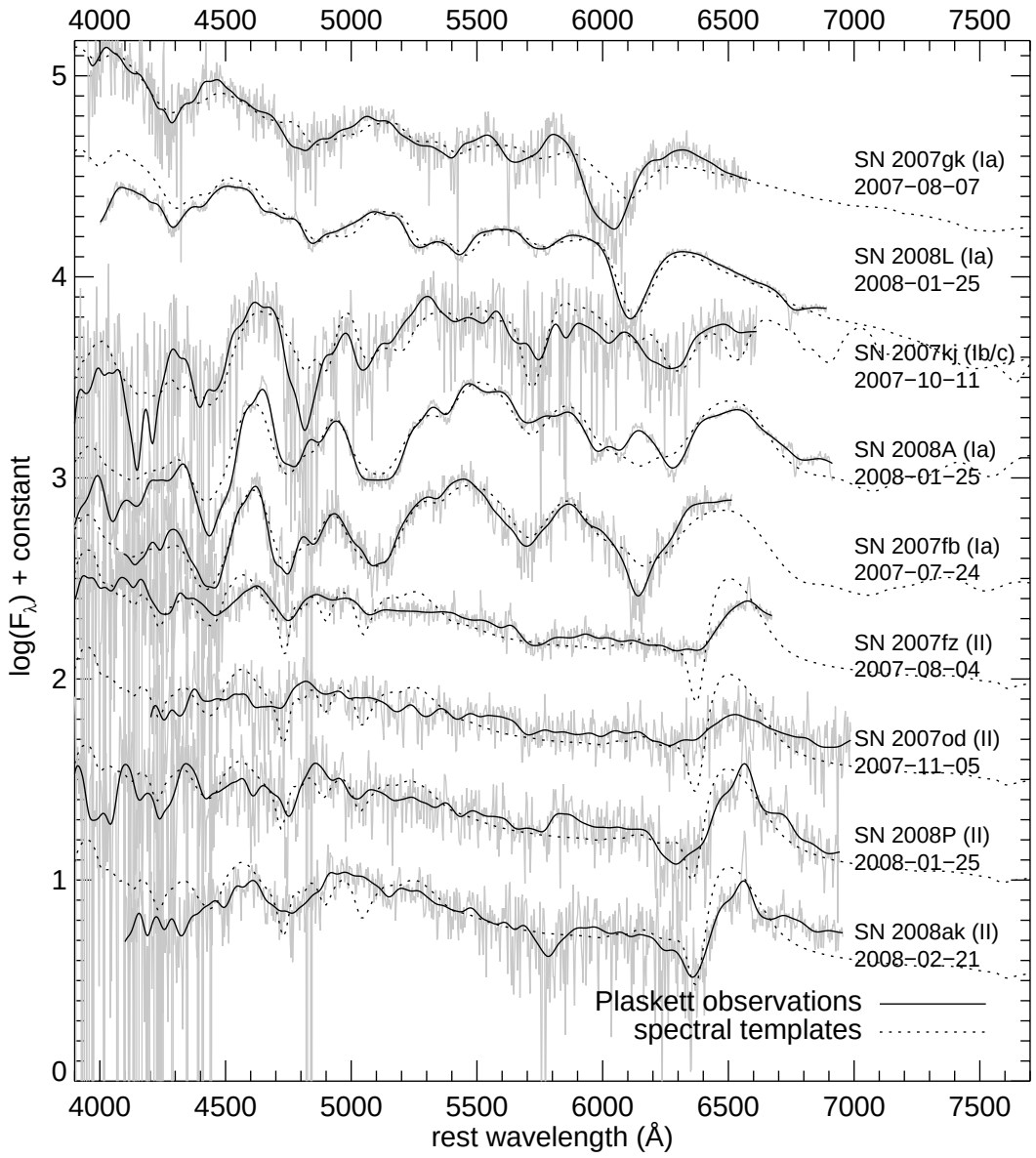

Figure 1: A subsample of the supernova spectra aquired by the Plaskett Spectroscopic Supernova Survey. The spectra have been dereshifted to the rest frame using the redshifts of the host galaxies. The observed spectra (solid curves) are compared with spectral templates (dotted curves) at the best fitting phases. Smoothed observed spectra are plotted to aid the comparisons. Observed dates and supernova types are also noted.

14. Targets:

Object/Field	α	δ	Epoch	Mag/Flux	Comment

13. General Target Information:

As supernovae are transient, targets will be selected from available sources of newly discovered supernovae such as IAU circulars and supernova detection surveys on a nightly basis. On a given night, three to four supernovae are observed from a target list of 10 to 20 supernovae.

14. Publications Resulting from DAO Observations *(only the 12 most recent contained in the database are displayed)*:

Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1219, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1224, 1
Hsiao, E. Y., Graham, M. L., Pritchet, C. J. & Balam, D. 2008, CBET, 1267, 1
Hsiao, E. Y., Graham, M. L., Balam, D. & Howell, D. A. 2007, CBET, 1025, 1
Iwamoto, K., Nakamura, T., Nomoto, K., Mazzali, P. A., Danziger, I. J., Garnavich, P., Kirshner, R., Jha, S., Balam, D. & Thorstensen, J. 2000, ApJ, 534, 660
Hurst, G. M., Boles, T., Armstrong, M., Benetti, S., Ghinassi, F., Marchetti, E., Tessicini, G., Vuerli, C., Zacchei, A., Balam, D., Sano, Y. & Yamaoka, H. 1998, IAU Circ., 7033, 1
Yamaoka, H., Kato, T., Filippenko, A. V., van Dyk, S. D., Yamamoto, M., Balam, D., Hornoch, K. & Plsek, M. 1998, IAU Circ., 6859, 1

Disclaimer: *In submitting this application, I acknowledge that I am aware of DAO's policy concerning public access to data after a proprietary period of one year.*

Signature: signed via "POOPSY"